

## WHAT IS CLAIMED IS:

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1. A catheter device for partitioning a patient's ascending aorta between the coronary ostia and the brachiocephalic artery, comprising:  
an elongated shaft having a distal end, a proximal end, a first inner lumen extending therebetween, an opening at the distal end in fluid communication with the first inner lumen; and  
an expandable means near the distal end of the shaft proximal to the opening in the first inner lumen for occluding the ascending aorta between the coronary ostia and the brachiocephalic artery so as to block substantially all systolic and diastolic blood flow therethrough, said expandable means being expandable eccentrically such that said expandable means has a first side and a second side, said first side expanding to a larger size than said second side.

2. The catheter device of claim 1 wherein said elongated shaft has a preshaped distal portion configured to conform generally to the patient's aortic arch such that the distal end is positionable within the ascending aorta.

3. The catheter device of claim 2 wherein said preshaped distal portion of said elongated shaft has a curvature with an inner side of the curve and an outer side of the curve and wherein said expandable means is oriented on said catheter shaft such that the larger first side of said expandable means is oriented toward the outer side of the curve and the second side of said expandable means is oriented toward the inner side of the curve.

4. The catheter device of claim 3 wherein the curvature of said preshaped distal portion of said elongated shaft subtends an angle of about 135° to about 225°.

1 5. The catheter device of claim 1 wherein said expandable means  
2 comprises an inflatable elastomeric balloon.

1 6. The catheter device of claim 5 wherein said elongated shaft has a a  
2 second inner lumen in fluid communication with an interior space within said  
3 inflatable elastomeric balloon.

1 7. The catheter device of claim 5 wherein the second side of said inflatable  
2 elastomeric balloon is more resistant to expansion than the first side of said  
3 inflatable elastomeric balloon.

1 8. The catheter device of claim 7 wherein the second side of said inflatable  
2 elastomeric balloon has a balloon wall thickness which is greater than the  
3 balloon wall thickness of the first side of said inflatable elastomeric balloon.

1 9. The catheter device of claim 1 wherein said expandable means  
2 comprises an inflatable inelastic balloon.

1 10. The catheter device of claim 5 wherein said elongated shaft has a a  
2 second inner lumen in fluid communication with an interior space within said  
3 inflatable elastomeric balloon.

1 11. The catheter device of claim 1 wherein said expandable means  
2 comprises an inflatable balloon having at least a portion of the second side of the  
3 inflatable balloon attached to said elongated shaft thereby restricting expansion of  
4 the second side of the inflatable balloon.

1 12. The catheter device of claim 1 wherein said elongated shaft comprises  
2 a third inner lumen in fluid communication with a second opening in said  
3 elongated shaft distal to said expandable means.

1 13. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft having a distal end, a proximal end, a first inner lumen  
4 extending therebetween, and an opening at the distal end in fluid  
5 communication with the first inner lumen; and

6 an expandable means near the distal end of the shaft proximal to the  
7 opening in the first inner lumen for occluding the ascending aorta between the  
8 coronary ostia and the brachiocephalic artery so as to block substantially all  
9 systolic and diastolic blood flow therethrough, said expandable means having a  
10 distal occlusive means for occluding the ascending aorta and a proximal  
11 stabilizing means for stabilizing said expandable means in a desired position  
12 within the ascending aorta.

1 14. The catheter device of claim 13 wherein said proximal stabilizing  
2 means does not occlude the ascending aorta.

1 15. The catheter device of claim 13 wherein said proximal stabilizing  
2 means does not block blood flow from the ascending aorta into the  
3 brachiocephalic artery.

1 16. The catheter device of claim 13 wherein said expandable means  
2 comprises an inflatable balloon.

1 17. The catheter device of claim 16 wherein said distal occlusive means  
2 comprises a distal portion of said inflatable balloon of sufficient diameter to

3 occlude the ascending aorta and said proximal stabilizing means comprises a  
4 proximal portion of said inflatable balloon having means for contacting an inner  
5 surface of the ascending aorta for stabilizing said expandable means in a desired  
6 position within the ascending aorta and at least one blood flow passage for  
7 allowing blood flow from the ascending aorta into the brachiocephalic artery.

1 18. The catheter device of claim 16 wherein said distal occlusive means  
2 comprises a distal portion of said inflatable balloon of sufficient diameter to  
3 occlude the ascending aorta and said proximal stabilizing means comprises a  
4 proximal portion of said inflatable balloon of sufficient diameter to contact an  
5 inner surface of the ascending aorta.

1 19. The catheter device of claim 18 wherein said inflatable balloon further  
2 comprises a region of reduced diameter between said distal portion and said  
3 proximal portion of said inflatable balloon.

1 20. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft comprising an inner tubular member within an outer  
4 tubular member, said inner tubular member having a distal end, a proximal end,  
5 a first inner lumen extending therebetween, and an opening at the distal end in  
6 fluid communication with the first inner lumen, a flow passage between said  
7 inner tubular member and said outer tubular member and

8 an inflatable balloon near the distal end of the shaft proximal to the  
9 opening in the first inner lumen for occluding the ascending aorta between the  
10 coronary ostia and the brachiocephalic artery so as to block substantially all  
11 systolic and diastolic blood flow therethrough, an interior space within said  
12 inflatable balloon being in fluid communication with said flow passage.

1 21. The catheter device of claim 20 wherein said inflatable balloon has a  
2 distal end attached to said inner tubular member and a proximal end attached to  
3 said outer tubular member.

1 22. The catheter device of claim 20 further comprising a pressure  
2 transducer means for measuring fluid pressure mounted on said elongated shaft  
3 distal to said expandable means.

1 23. The catheter device of claim 22 further comprising a second pressure  
2 transducer means for measuring fluid pressure mounted on said elongated shaft  
3 within said expandable means.

1 24. The catheter device of claim 20 wherein said inner tubular member  
2 comprises a third inner lumen in fluid communication with a second opening  
3 in said inner tubular member distal to said expandable means.

1 25. The catheter device of claim 21 wherein said inner tubular member is  
2 axially movable with respect to said outer tubular member.

1 26. The catheter device of claim 25 further comprising a locking means for  
2 selectively locking said inner tubular in a desired position with respect to said  
3 outer tubular member.

1 27. The catheter device of claim 25 wherein said catheter device has a  
2 collapsed position in which said inflatable balloon is deflated and said outer  
3 tubular member is withdrawn proximally with respect to said inner tubular  
4 member thereby collapsing said inflatable balloon around said inner tubular  
5 member.

1           28. The catheter device of claim 25 wherein said catheter device has a  
2 deployed position in which said inflatable balloon is inflated and said outer  
3 tubular member is advanced distally with respect to said inner tubular member.

1           29. The catheter device of claim 28 when said catheter device is in said  
2 deployed position said inflatable balloon has a length-to-diameter ratio of less  
3 than about 1.

1           30. The catheter device of claim 25 wherein said catheter device has a first  
2 deployed position in which said outer tubular member is advanced distally to an  
3 intermediate position with respect to said inner tubular member and said  
4 inflatable balloon is inflated to a generally spherical shape, and a second deployed  
5 position in which said outer tubular member is advanced distally with respect to  
6 said inner tubular member and said inflatable balloon is inflated to a generally  
7 toroidal shape.

1           31. The catheter device of claim 25 wherein said catheter device is  
2 selectively deployable by advancing said outer tubular member distally to a  
3 selected position with respect to said inner tubular member and inflating said  
4 inflatable balloon whereby said balloon is selectively deployed to have a length-  
5 to-diameter ratio of less than 1, equal to about 1, or greater than 1.

1           32. The catheter device of claim 24 wherein said inner tubular member is  
2 rotatable with respect to said outer tubular member.

1           33. The catheter device of claim 32 wherein said catheter device has a  
2 collapsed position in which said inflatable balloon is deflated and said outer  
3 tubular member is rotated with respect to said inner tubular member thereby  
4 twisting said inflatable balloon around said inner tubular member.

1 34. The catheter device of claim 21 wherein said inner tubular member is  
2 rotatable and axially movable with respect to said outer tubular member.

1 35. The catheter device of claim 34 wherein said catheter device has a  
2 collapsed position in which said inflatable balloon is deflated and said outer  
3 tubular member is withdrawn proximally and rotated with respect to said inner  
4 tubular member thereby collapsing and twisting said inflatable balloon around  
5 said inner tubular member.

1 36. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft having a distal end, a proximal end, a first inner lumen  
4 extending therebetween, and an opening at the distal end in fluid  
5 communication with the first inner lumen; and

6 an expandable means near the distal end of the shaft proximal to the  
7 opening in the first inner lumen for occluding the ascending aorta between the  
8 coronary ostia and the brachiocephalic artery so as to block substantially all  
9 systolic and diastolic blood flow therethrough; and

10 a pressure transducer means for measuring fluid pressure mounted on  
11 said elongated shaft.

1 37. The catheter device of claim 36 wherein said pressure transducer  
2 means is mounted on said elongated shaft distal to said expandable means.

1 38. The catheter device of claim 36 wherein said pressure transducer  
2 means is mounted on said elongated shaft within said expandable means.

1 39. The catheter device of claim 38 further comprising a second pressure  
2 transducer means for measuring fluid pressure mounted on said elongated shaft  
3 distal to said expandable means.

1 40. A balloon catheter comprising:  
2 an elongated shaft comprising an inner tubular member within an outer  
3 tubular member, said inner tubular member having a distal end, a proximal end,  
4 a first inner lumen and a second inner lumen extending therebetween, a first  
5 opening at the distal end in fluid communication with the first inner lumen,  
6 and a second opening at the distal end in fluid communication with the second  
7 inner lumen; and  
8 an inflatable balloon near the distal end of the shaft, an interior space  
9 within said inflatable balloon being in fluid communication with an inflation  
10 lumen defined by a space between said inner tubular member and said outer  
11 tubular member.

1 41. The catheter device of claim 40 wherein said inflatable balloon has an  
2 inflated diameter sufficient for occluding the ascending aorta between the  
3 coronary ostia and the brachiocephalic artery so as to block substantially all  
4 systolic and diastolic blood flow therethrough

1 42. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft having a distal end, a proximal end, a first inner lumen  
4 extending therebetween, and an opening at the distal end in fluid  
5 communication with the first inner lumen;

6 a first expandable means near the distal end of the shaft proximal to the  
7 opening in the first inner lumen for occluding the ascending aorta between the



8 coronary ostia and the brachiocephalic artery so as to block substantially all  
9 systolic and diastolic blood flow therethrough; and

10 a second expandable means near the distal end of the shaft distal to the  
11 first expandable means for protecting the distal end of the shaft from contact with  
12 an inner surface of the ascending aorta.

1 43. The catheter device of claim 42 wherein said first expandable means  
2 comprises a first inflatable balloon.

1 44. The catheter device of claim 42 wherein said second expandable means  
2 comprises a second inflatable balloon.

1 45. The catheter device of claim 44 wherein said second inflatable balloon  
2 has a distal end which is inverted and attached to said shaft proximate said distal  
3 end of the shaft.

1 46. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft having a distal end, a proximal end, a first inner lumen  
4 extending therebetween, an opening at the distal end in fluid communication  
5 with the first inner lumen, and a preshaped distal portion having a curvature  
6 which subtends an angle of about 225° to about 315°; and

7 expandable means near the distal end of the shaft proximal to the opening  
8 in the first inner lumen for occluding the ascending aorta between the coronary  
9 ostia and the brachiocephalic artery so as to block substantially all systolic and  
10 diastolic blood flow therethrough.

1 47. The catheter device of claim 46 wherein said expandable means  
2 comprises an inflatable balloon.

1           48. The catheter device of claim 46 wherein said preshaped distal portion  
2 has a first segment contiguous with a proximal portion of the shaft, said first  
3 segment having a first radius of curvature, and a second segment contiguous  
4 with said first segment, said second segment having a second radius of curvature  
5 less than said first radius of curvature.

1           49. The catheter device of claim 48 wherein said preshaped distal portion  
2 is configured such that when said catheter device is inserted into the patient's  
3 aorta the distal end resides in the ascending aorta, the second segment extends  
4 from the ascending aorta over the aortic arch and the first segment resides in the  
5 descending aorta.

1           50. The catheter device of claim 48 wherein said preshaped distal portion  
2 further comprises a generally straight third segment contiguous with said second  
3 segment.

1           51. The catheter device of claim 50 wherein said third segment is angled  
2 relative to said second segment.

1           52. The catheter device of claim 50 wherein said third segment is skewed  
2 relative to said proximal portion of the shaft.

1           53. The catheter device of claim 46 wherein said preshaped distal portion  
2 has a distal segment which is skewed relative to a proximal portion of the shaft.

1           54. The catheter device of claim 46 further comprising means for  
2 straightening the distal portion of the shaft to facilitate introducing the shaft into  
3 an artery downstream of the patient's ascending aorta.

1 55. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft having a distal end, a proximal end, and an inflation  
4 lumen extending therebetween; and

5 an inflatable balloon near the distal end of the shaft for occluding the  
6 ascending aorta between the coronary ostia and the brachiocephalic artery so as to  
7 block substantially all systolic and diastolic blood flow therethrough, an interior  
8 space within said inflatable balloon being in fluid communication with said  
9 inflation lumen, said inflation lumen being configured to allow inflation of said  
10 interior space of said inflatable balloon to a volume of about 40 cc with an  
11 aqueous inflation medium in a time of less than about 40 seconds.

1 56. The catheter device of claim 55 wherein said inflation lumen is  
2 configured to allow inflation of said interior space of said inflatable balloon to a  
3 volume of about 40 cc with an aqueous inflation medium in a time of less than  
4 about 20 seconds.

1 57. The catheter device of claim 55 wherein said elongated shaft has a  
2 length sufficient to allow said distal end to be positioned in the patient's  
3 ascending aorta with said proximal end extending out of a peripheral artery of  
4 the patient.

1 58. The catheter device of claim 57 wherein said elongated shaft has a  
2 length of at least 80 cm to facilitate transluminal positioning from a femoral  
3 artery to the ascending aorta.

1 59. The catheter device of claim 55 wherein said inflatable balloon is  
2 inflatable to a volume of about 40 cc with an aqueous inflation medium in a time

3 of less than about 40 seconds with an inflation pressure not exceeding 35 psi  
4 measured at the proximal end of said inflation lumen.

1 60. The catheter device of claim 55 wherein said elongated shaft further  
2 comprises an infusion lumen extending between the proximal end and the distal  
3 end of the shaft, and an opening in said shaft distal to said inflatable balloon in  
4 fluid communication with the infusion lumen.

1 61. The catheter device of claim 55 wherein said inflation lumen has a  
2 cross sectional area of at least 0.5 mm<sup>2</sup>.

1 62. The catheter device of claim 55 wherein said inflatable balloon is  
2 inflatable to a volume of about 40 cc with an aqueous inflation medium  
3 containing a radiopaque contrast agent in a time of less than about 40 seconds.

1 63. A catheter device for partitioning a patient's ascending aorta between  
2 the coronary ostia and the brachiocephalic artery, comprising:

3 an elongated shaft having a distal end, a proximal end, a first inner lumen  
4 extending therebetween, an opening at the distal end in fluid communication  
5 with the first inner lumen, and a preshaped distal portion configured to conform  
6 generally to the patient's aortic arch such that the distal end is positionable  
7 within the ascending aorta with the distal end of the elongated shaft in proximity  
8 to an anterior wall of the ascending aorta; and

9 an expandable means near the distal end of the shaft proximal to the  
10 opening in the first inner lumen for occluding the ascending aorta between the  
11 coronary ostia and the brachiocephalic artery so as to block substantially all  
12 systolic and diastolic blood flow therethrough.

1 64. A method of partitioning a patient's ascending aorta between the  
2 patient's coronary ostia and the patient's brachiocephalic artery, comprising:  
3 introducing a distal end of a shaft of an aortic partitioning device into a  
4 blood vessel downstream of the patient's ascending aorta;  
5 transluminally positioning the shaft so that the distal end of the shaft is in  
6 the ascending aorta and an expandable occluding member attached to the shaft  
7 near the distal end is disposed between the coronary ostia and the brachiocephalic  
8 artery; and  
9 expanding the occluding member eccentrically about the shaft of the aortic  
10 partitioning device within the ascending aorta to completely block blood flow  
11 therethrough.

1 65. The method of claim 64 wherein the occluding member is eccentrically  
2 expanded about the shaft of the aortic partitioning device with a larger side of the  
3 occluding member oriented toward the outside of the greater curvature of the  
4 patient's aortic arch.

1 66. The method of claim 64 wherein the shaft of the aortic partitioning  
2 device is positioned with a curved portion of the shaft within the patient's aortic  
3 arch.

1 67. The method of claim 66 wherein the curved portion of the shaft  
2 conforms generally to the curve of the patient's aortic arch and the occluding  
3 member is eccentrically expanded about the shaft of the aortic partitioning device  
4 with a larger side of the occluding member oriented the outside of the greater  
5 curvature of the patient's aortic arch.

1        68. The method of claim 64 further comprising the step of infusing a  
2 cardioplegic agent through a lumen within the shaft having an opening distal to  
3 the occluding member.

1        69. A method of partitioning a patient's ascending aorta between the  
2 patient's coronary ostia and the patient's brachiocephalic artery, comprising:

3        introducing a distal end of a shaft of an aortic partitioning device into a  
4 blood vessel downstream of the patient's ascending aorta;

5        transluminally positioning the shaft so that the distal end of the shaft is in  
6 the ascending aorta and an expandable occluding member attached to the shaft  
7 near the distal end is disposed between the coronary ostia and the brachiocephalic  
8 artery and a nonocclusive stabilizing member is positioned downstream of the  
9 occluding member; and

10        expanding the occluding member within the ascending aorta to completely  
11 block blood flow therethrough and expanding the stabilizing member to contact  
12 an inner wall of the aorta.

1        70. The method of claim 69 wherein the step of expanding the occluding  
2 member and the stabilizing member comprises the substep of inflating an  
3 expandable balloon having the occluding member located on a distal portion of  
4 the balloon and the stabilizing member located on a proximal portion of the  
5 balloon.

1        71. The method of claim 69 wherein the expandable occluding member is  
2 expanded in a position immediately upstream of the brachiocephalic artery.

1        72. The method of claim 69 wherein the stabilizing member is expanded  
2 without the stabilizing member occluding the patient's ascending aorta.

1           73. The method of claim 69 further comprising the step of positioning a  
2 blood flow passage within the stabilizing member to allow blood flow from the  
3 ascending aorta into the brachiocephalic artery.

1           74. A method of partitioning a patient's ascending aorta between the  
2 patient's coronary ostia and the patient's brachiocephalic artery, comprising:

3           introducing a distal end of a shaft of an aortic partitioning device into a  
4 blood vessel downstream of the patient's ascending aorta, the shaft comprising  
5 an inner tubular member within an outer tubular member;

6           transluminally positioning the shaft so that the distal end of the shaft is in  
7 the ascending aorta and an expandable occluding member attached to the shaft  
8 near the distal end is disposed between the coronary ostia and the brachiocephalic  
9 artery; and

10          expanding the occluding member within the ascending aorta to completely  
11 block blood flow therethrough.

1           75. The method of claim 74 wherein the expandable occluding member  
2 comprises an inflatable balloon having a distal end attached to said inner tubular  
3 member and a proximal end attached to said outer tubular member and wherein  
4 the step of expanding the occluding member comprises the substep of inflating  
5 the balloon by passing an inflation fluid through a flow passage between the  
6 inner tubular member and the outer tubular member.

1           76. The method of claim 75 further comprising the step of measuring  
2 pressure within the inflatable balloon with a pressure transducer within the  
3 inflatable balloon.

1           77. The method of claim 74 wherein the step of introducing the distal end  
2 of the shaft into a blood vessel is preceded by the step of withdrawing the outer

3 tubular member proximally with respect to the inner tubular member to reduce  
4 the profile of the occluding member on the shaft of the aortic partitioning device.

1 78. The method of claim 74 wherein the step of introducing the distal end  
2 of the shaft into a blood vessel is preceded by the step of rotating the outer  
3 tubular member with respect to the inner tubular member to reduce the profile  
4 of the occluding member on the shaft of the aortic partitioning device.

1 79. The method of claim 74 further comprising the step of measuring  
2 aortic pressure distal to the occluding member.

1 80. The method of claim 74 further comprising the step of measuring  
2 aortic pressure distal to the occluding member with a pressure transducer  
3 nearthe distal end of the shaft.

1 81. The method of claim 74 further comprising the step of measuring  
2 aortic pressure distal to the occluding member with a pressure transducer  
3 nearthe distal end of the shaft.

1 82. A method of partitioning a patient's ascending aorta between the  
2 patient's coronary ostia and the patient's brachiocephalic artery, comprising:

3 introducing a distal end of a shaft of an aortic partitioning device into a  
4 blood vessel downstream of the patient's ascending aorta, the shaft comprising  
5 an inner tubular member within an outer tubular member;

6 advancing the shaft so that the distal end of the shaft is in the aorta and  
7 expanding a distal expandable member attached to the shaft near the distal end of  
8 the shaft to protect the distal end of the shaft from contact with an inner surface  
9 of the aorta; and



transluminally positioning the shaft so that the distal end of the shaft is in the ascending aorta and an expandable occluding member attached to the shaft proximal to the distal expandable member is disposed between the coronary ostia and the brachiocephalic artery; and  
expanding the occluding member within the ascending aorta to completely block blood flow therethrough.

83. The method of claim 82 wherein the step of transluminally positioning the shaft so that the distal end of the shaft is in the ascending aorta includes the substep of advancing the shaft until the expanded distal expandable member contacts the patient's aortic valve.

84. A method of partitioning a patient's ascending aorta between the patient's coronary ostia and the patient's brachiocephalic artery, comprising:  
introducing a distal end of a shaft of an aortic partitioning device into a blood vessel downstream of the patient's ascending aorta;  
transluminally positioning the shaft so that the distal end of the shaft is in the ascending aorta with the distal end of the elongated shaft in proximity to a wall of the ascending aorta which is most elevated and an expandable occluding member attached to the shaft near the distal end is disposed between the coronary ostia and the brachiocephalic artery; and  
expanding the occluding member within the ascending aorta to completely block blood flow therethrough.

85. The method of claim 84 further comprising the step of venting the ascending aorta through a lumen connecting with the distal end of the shaft.

86. The method of claim 85 including the step of placing the patient supine so that the wall of the ascending aorta which is most elevated is an

3 anterior wall of the ascending aorta and the distal end of the elongated shaft is in  
4 proximity to the anterior wall so that any air within the ascending aorta is  
5 withdrawn through the lumen of the aortic partitioning device in the venting  
6 step.

1 87. A cannula adapted to permit passage therethrough of a catheter for  
2 percutaneous insertion in the body of a patient, said cannula comprising:

3 a cannula body having a proximal end, a distal end and a cannula lumen,  
4 a first leg connected to said proximal end of said cannula body, said first leg  
5 having a blood flow lumen in fluid communication with said cannula lumen,  
6 a second leg having a proximal end and a distal end, said distal end of said  
7 second leg being connected to said proximal end of said cannula body, said second  
8 leg having a catheter insertion lumen in fluid communication with said cannula  
9 lumen,

10 a first hemostasis means for selectively preventing fluid flow between said  
11 cannula lumen and said catheter insertion lumen, and

12 a second hemostasis means for preventing fluid flow from the proximal  
13 end of said catheter insertion lumen, said second hemostasis means being spaced  
14 apart from said first hemostasis means to create a catheter insertion chamber  
15 within said catheter insertion lumen.

1 88. The cannula of claim 87 wherein said second hemostasis means  
2 comprises a resilient sealing member having an opening therethrough, and a  
3 compression means for compressing said resilient sealing member to selectively  
4 occlude said opening.

1 89. The cannula of claim 87 wherein said first hemostasis means has an  
2 open position which allows free passage of a catheter from said catheter insertion  
3 lumen into said cannula lumen.

1 90. The cannula of claim 89 wherein said first hemostasis means  
2 comprises a flexible tubular member intermediate said proximal end and said  
3 distal end of said second leg and an external clamp means for clamping said  
4 flexible tubular member to occlude said catheter insertion lumen.

1 91. The cannula of claim 87 wherein said second hemostasis means has a  
2 closed position which prevents fluid flow from the proximal end of said catheter  
3 insertion lumen, and an open position which allows insertion of a catheter  
4 through said second hemostasis means into said catheter insertion lumen.

1 92. The cannula of claim 91 wherein said second hemostasis means  
2 provides an open passage for insertion of a catheter through said second  
3 hemostasis means when said second hemostasis means is in said open position.

1 93. The cannula of claim 91 wherein said open passage has a diameter of at  
2 least 5 mm when said second hemostasis means is in said open position.

1 94. The cannula of claim 91 wherein said second hemostasis means  
2 provides a sliding hemostatic seal around a shaft of a catheter inserted through  
3 said second hemostasis means when said second hemostasis means is in said  
4 open position.

1 95. The cannula of claim 91 wherein said second hemostasis means has an  
2 intermediate position which creates a seal against an external surface of said  
3 catheter to prevent fluid flow from the proximal end of said catheter insertion  
4 lumen when said catheter is inserted through said second hemostasis means.

1           96. The cannula of claim 95 wherein said second hemostasis means  
2 provides a sliding hemostatic seal around a shaft of a catheter inserted through  
3 said second hemostasis means when said second hemostasis means is in said  
4 intermediate position.

1           97. The cannula of claim 95 wherein said second hemostasis means is  
2 selectively movable between said open position, said closed position and said  
3 intermediate position.

1           98. The cannula of claim 87 further comprising a third hemostasis means  
2 for selectively preventing fluid flow through said cannula lumen.

1           99. The cannula of claim 98 wherein said third hemostasis means  
2 comprises a flexible tubular member intermediate said proximal end and said  
3 distal end of said cannula body and an external clamp means for clamping said  
4 flexible tubular member to occlude said cannula lumen.

1           100. The cannula of claim 87 further comprising a lubricious coating on an  
2 interior surface of said cannula lumen and an interior surface of said catheter  
3 insertion lumen.

1           101. The cannula of claim 87 further comprising a lubricious coating on an  
2 exterior surface of at least a distal portion of said cannula body.

1           102. The cannula of claim 87 wherein said cannula body has a tapered  
2 distal portion having a distal external diameter which is smaller than a proximal  
3 external diameter of said cannula body.

1 103. The cannula of claim 87 wherein at least a distal portion of said  
2 cannula body is reinforced with a coiled wire embedded in a wall of said cannula  
3 body.

1 104. The cannula of claim 87 in combination with an aortic partitioning  
2 catheter means for occluding a patient's ascending aorta between the coronary  
3 ostia and the brachiocephalic artery, said aortic partitioning catheter means  
4 having a distal end dimensioned for passage through said catheter insertion  
5 lumen.

1 105. An adapter for proximal attachment to a cannula for placement in a  
2 blood vessel comprising:

3 a first leg having a proximal end, a distal end and a first lumen  
4 therebetween;

5 a second leg having having a proximal end, a distal end and a second  
6 lumen therebetween, the distal end of the second arm being attached to the first  
7 arm such that the second lumen is in fluid communication with the first lumen;

8 a first hemostasis means in a distal portion of the first arm for selectively  
9 preventing fluid flow through the first lumen;

10 a second hemostasis means in a proximal portion of the first arm for  
11 selectively preventing fluid flow through the first lumen; and

12 means for attaching the adapter to a proximal end of the cannula.

1 106. A repositionable securing device for securing an elongated medical  
2 instrument in a selected position, said repositionable securing device comprising:

3 a tubular member having a lumen therethrough to slidably receive said  
4 elongated medical instrument therein, said lumen having a high friction  
5 material on an inner surface of said lumen; and

6 means for compressing said tubular member around said elongated  
7 medical instrument to frictionally secure said tubular member to said elongated  
8 medical instrument.

1 107. The repositionable securing device of claim 106 wherein said tubular  
2 member has a longitudinal slot communicating with said lumen along at least a  
3 portion of said tubular member which renders said tubular member more easily  
4 compressible around said elongated medical instrument.

1 108. The repositionable securing device of claim 106 wherein said high  
2 friction material comprises particles adhered to the inner surface of said lumen  
3 to increase friction between said inner surface and said elongated medical  
4 instrument.

1 109. The repositionable securing device of claim 106 wherein said means  
2 for compressing said tubular member around said elongated medical instrument  
3 comprises a suture or ligature tied around an exterior surface of said tubular  
4 member.

1 110. The repositionable securing device of claim 106 wherein said exterior  
2 surface of said tubular member further comprises a means for securing said  
3 suture or ligature to said tubular member.

1 111. The repositionable securing device of claim 106 wherein said means  
2 for securing said suture or ligature to said tubular member comprises at least one  
3 circumferential groove in the exterior surface of said tubular member.

1 112. The repositionable securing device of claim 106 wherein said tubular  
2 member has a longitudinal slot communicating with said lumen along at least a

3 portion of said tubular member which renders said tubular member more easily  
4 compressible around said elongated medical instrument, said high friction  
5 material comprises particles adhered to the inner surface of said lumen to  
6 increase friction between said inner surface and said elongated medical  
7 instrument, said means for compressing said tubular member around said  
8 elongated medical instrument comprises a suture or ligature tied around an  
9 exterior surface of said tubular member, and said tubular member further  
10 comprises at least one circumferential groove in said exterior surface of said  
11 tubular member for securing said suture or ligature to said tubular member.

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